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"Copping" in Heroin Markets: The Hidden Information Costs of Indirect Sales and Why They Matter

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Abstract. Ethnographic research identifies brokering (a.k.a., "copping for others") as an important and popular way people who use heroin acquire the drug by making purchases for their peers. Brokering is when a customer buys drugs for a fellow customer using the buyer's money and is paid using drug the buyer purchases. This distributes heroin costs. Heroin dealers obviously manipulate price and/or drug purity to make profits and compete for buyers, but a hidden way they alter "price" is by adjusting the size of heroin packages they sell. Using an agent-based model, we simulate brokering and heroin package resizing to understand how these dynamics influence heroin consumption costs. High rates of dealer arrest are tested against these dynamics. Findings indicate the Quantity-Adjusted Price of heroin is greater than its retail price in all conditions, implying increased competition in heroin markets does not lower costs.

Keywords: Agent-based modeling, ethnography, heroin dealing, hidden costs.

1 Introduction

A fundamental assumption of U.S. drug policy is that the consumption costs of heroin are a linear function of the drugs retail price. Features of the market such as competition and law enforcement are, in turn, assumed to affect this price to increase or decrease costs. Daily heroin users are estimated to spend 60-72% of their monthly income on heroin consumption [1-3], spend more compared to cocaine users [3], and use cash as the number one commodity exchanged for heroin [3]. However, heroin users often report spending less on the drug than they report using [4] suggesting simplistic projections of annual costs are flawed, e.g., a $20 per-day drug habit costs $7300 annually or a gram per-day (at $120 per-gram) costs $43,800.

Documenting real-world cash spending on heroin is challenging because consumers employ a host of strategies to acquire the drug without cash or reduce expenditures [3-4]. People trade goods or sex for drugs; get money from friends and family; and pool resources with their peers to reduce their individual cash expenditures. Some customers acquire drugs on credit from their dealers, sell heroin or participate in other income generating crime to offset drug consumption costs.

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The agent-based model (ABM) we present estimates heroin consumption costs by characterizing two behaviors that are more consistent and basic to most, if not all, heroin markets: 1) brokering, a.k.a. "copping drugs for others" (by customers), and 2) drug package resizing (by dealers). These activities are selected because although documented independently, and quite common, the feedback between them and their influence on cost has been overlooked and never modeled. Brokering is how many heroin users describe acquiring heroin "for free."

2 Ethnographic Research on Heroin Markets

Unlike the immense literature on heroin (and opiate) addiction, a smaller literature in the social sciences describes how local illegal drug markets and drug dealers operate. Though the content of such studies is often unique, a challenge to theory development [6], the primary method used in the majority of this research is ethnography, which involves detailed longitudinal fieldwork with drug users and dealers to understand their decisions, as well as the social and political contexts of behaviors within these settings [7]. Since 1993, the anthropologist co-author of this paper (Hoffer) has conducted ethnographic research in Denver, Colorado, St. Louis, Missouri, and Cleveland, Ohio on illegal drug buying and selling activities among out-of-treatment drug users. As a result, the data represented in this ABM comes from different studies. Hoffer's fieldwork investigated an extensive range of operational activities associated with selling heroin. It addressed brokering as a process through which dealers accessed new customers and insulated their operations from the police, but also as an important way the market adapted to police interventions to dismantle it, a case simulated using ABM [5].

2.1 Brokering a.k.a. "Copping for Others"

A conventional face-to-face drug deal is a direct transaction between a heroin buyer and a seller. "Copping for others" is what heroin users refer to when one user purchases heroin for another user. Here, we call this *brokering*. Although brokering involves buying heroin from a dealer, it is an indirect transaction between customers: user *A* (the broker) takes user *B*'s (the buyer's) money, goes to a dealer, buys the drug, and returns to user *B*. Because the available cash is converted into heroin, user *B* then gives user *A* heroin as a "payment" for making the sale, and the transaction is complete. Buyers who use brokers pay more for heroin because they pay the broker in addition to purchasing the drug.

Brokering is important because it is a common strategy that heroin users employ to reduce their drug consumption costs [4, 8-9]. Brokers are not drug dealers. Although brokers may represent themselves to others as dealers, they do not invest in a quantity of drug to resell, they simply buy heroin for someone using that person's money. This also separates brokering from "juggling", a term describing a customer who buys heroin and repackages it into smaller quantities to resell [10-11].

Norms associated with brokering (i.e., copping) are clear: brokering is a service to a buyer not a seller; therefore, a buyer pays the broker. But despite payment expectations, because the buyer is not with the broker at the actual sale, brokers frequently hustle additional heroin "payments" during this transaction [8-9]. This makes brokering an attractive but risky drug acquisition strategy. In an extensive study on the economics of heroin use, copping combined with "touting and steering[1]" was estimated to save users $3,000 and occurred more frequently than direct drug sales [4]. Moreover, brokering also builds community between heroin users. For these transactions to work, which they do more often than not, users must trust one another. A buyer trusts the broker to make a purchase and return with drug; a broker trusts that if they do so the buyer will reward them [8, 12]. In this way, brokering is a "favor" and an economic service. Finally, because brokers often use heroin with buyers as part of the transaction, it increases HIV risks associated with injecting [13-14].

On one hand, buyers and dealers strive to make direct connections because they understand brokers manipulate the economics of transactions and it is not uncommon that a broker is cut out when buyers achieve this. On the other hand, brokers are highly motivated to maintain their position because it saves them money. The ways that brokering transmits market information is underappreciated in previous research. Through these dynamics, buyers learn about deals, products, and price, as well as identify access points for direct dealer relations.

Brokering redistributes wealth (heroin) from people with money and no dealers to people with dealers and no money. This commodified gatekeeping influences individual consumption costs, which is known. How brokering changes deal values in the marketplace (i.e., its aggregate influence on cost), through deal communications is unknown. Brokering is how buyers get information to make decisions. How much does sharing information about deals adjust and/or stabilize the size of heroin packages, i.e., dealer offers? And if we calculate the total cost of direct heroin sales, calculate the costs/savings of brokering, and adjust this to heroin package amounts sold, (i.e., true deal value) can we calculate a Quantity-Adjusted Price of heroin? And what affect does police intervention, i.e., arresting dealers, have in altering these dynamics?

2.2 Price Adjustment of Heroin in the Market

Heroin dealers also influence buyers' costs to consume heroin. Dealers raise or lower prices and/or "step-on" / "cut" the drug to stretch their supply, lowering potency to increase profits. Lowering potency requires customers to increase purchases, hence cost, but because they compete with other dealers, they risk losing sales or lowering the quality of drug. Heroin addicts frequently budget purchases and, like any consumer, desire stable prices. Our agent-based model simulates a less obvious strategy dealers employ in this situation; keeping prices constant but modifying the *amount* of drug sold in sales units. We label this *drug package resizing*.

[1] In touting and steering a seller (dealer) pays a customer to market their product, and although different than brokering, they were combined in this analysis.

Dealers sell different units of heroin, such as "bags", "pills", half-grams, grams, etc., standardizing prices by weight. However, in Hoffer's research [8], such sales units were rarely actually weighed. Instead, as the dealers received orders, they "eyeballed" the size of the unit to sell. Dealers were extremely accurate in estimating weights; on several occasions the researcher weighed "eyeballed" grams and found them to be within 1% of the true gram weight. But dealers also purposefully manipulated unit sizes to control customer behaviors, and compete for profits. If a customer acted in a way the dealer did not like, their next order would be "short" (i.e., less than the regular size). Alternatively, to reward customers, a dealer would make them a "fat" package (i.e., a larger than usual sale). Similarly, when sales were down, dealers made bigger units to attract/retain customers. When they had more sales, smaller units were made to extract more profit. Even though retail prices were constant, amounts were not.

Instances of dealers "shorting" customers appear in the ethnographic literature but detailed analyses of drug package resizing are rare. A notable exception is Lisa Maher's research on heroin trends in Australia in which she describes both drug package resizing and how dealers attract customers by up-sizing packages [15]. But evidence of this also comes in a more popular form: Dealers commonly reward good customers with extra bags of heroin or a better deal when they purchase larger heroin units.

Heroin dealers leverage the size of drug packages as a tool to take advantage of profit opportunities and control customer behavior, thus veiling price changes. To customers bigger units = better value/lower costs, and smaller units = worse value/ higher costs. Of course, product downsizing to lower cost and increase profits is not just for drug dealers. It is a common strategy manufacturers of legal goods use to hide price increases on commodities ranging from ice cream to toilet paper [16]; although it is unclear if these changes increase consumption, they do increase profits [17].

3 The Heroin Market Agent-Based Model[2]

Our model simulates interactions between people who buy and sell heroin to expand our existing understanding of local drug markets as complex systems [5] and connect micro-behavior and macro-market patterns associated with how much users spend to consistently consume heroin. We implement two types of agents: dealers (sellers) and customers (buyers). To reduce the parameter space, we exclude real world variables such as addiction, cash income, and variations in different drug units sold. Customer agents are automated consumers that: 1) never run out of money, 2) all purchase and consume the same unit of drug, one gram per transaction, and 3) always pay the same retail price, $120 per gram.

Customer agents schedule drug purchases based on a linear time scale set by the previous gram they consume. A gram is divided into equal units for this purpose; a 12-unit gram represents a full-sized gram. For customer agents, a 12-unit gram means an agent will make another purchase in eight hours; a 6-unit gram in six hours and so

[2] A technical description and source code is available at: `http://code.google.com/p/drug-market`

on[3]. This proxy's variation in the "size" of grams sold: more units = bigger grams (in real terms, each 1/12 increment equates roughly to an 8% change in gram size). It also allows agents to evaluate the *quality* of the product. Heroin is an "experience good," meaning consumers can only judge its quality *after* it is consumed [18]. A "good" deal is one in which the customer gets more heroin than a previous deal.

Customer agents have a (customer-to-dealer) *transaction* and a (customer-to-customer) *social* network. To purchase heroin they must have a direct link with a dealer or another customer (acting as a broker) who has a direct link with a dealer. At the start of the simulation, each customer agent is assigned some dealer agents. The agent selects the dealer from their *transaction* network offering the best value deal. If that dealer is unavailable, they go to the next best dealer, and so on. If a customer agent is not able to purchase from a dealer, they seek a deal from their *social* network.

In our model, seeking a deal from its *social* network, the customer agent uses a preferential ordering scheme based on the net good vs. bad deals shared by its social contacts over the past 30 days. The agent first asks the peer who has given them the best deal, the next best, and so on. A shared deal purchase is evaluated relative to all the customer agents' previous purchases. Social network ties dissolve when resulting deals are "not good" *n* number of times. Ties are assumed symmetric; dropping ties is mutual and we assume it will take time before they can re-establish their tie (by default, we assume a lag of 3 months).

Agents add a new dealer to their *transaction* network after purchasing a shared deal from another customer (a broker) *n* number of times (a model parameter). New *social* network ties are formed using a probability that increases based on the number of overlapping dealers two customer agents have in common. Customer agents who share deals (broker) receive a commission, fixed at $20 or variable depending upon model setup, from the agent they broker for and always offer the best deal from their *transaction* network. At the start, customer agents are linked in a *social* network constructed using one of the three network topologies Watts-Strogatz, Barabasi-Albert and Erdos-Renyi, see [19]. Parameters are set so approximately one new social network link is established per month. Customer agents dissolve ties with dealers in three ways: Customers drop dealer links if 1) they do not transact with the dealer for 7 days, 2) a dealer agent is "arrested" or fails (see below) or 3) if a dealer "franchises" their operation a customer link can be transferred to a new dealer, dissolving the old tie.

Dealer agents sell grams of heroin and resize grams in response to what is happening in their network of buyers. Dealers are supplied 12 grams at a time and are immediately resupplied when they sell out. Based on their sales activity, a dealer agent will 1) up-size their grams to attract customers and 2) downsize their grams if they have more customers and want to extract more profit. The simulation is configured so dealers change the size of their grams infrequently. If a dealer agent becomes too busy for too long they franchise their operations, randomly transferring half of their customers to a random customer, i.e., new dealer. New dealers sell gram units the same size as their benefactors or downsize to make more profit (a model parameter). Finally,

[3] Although somewhat arbitrary, this linear unit-to-time scale does reflect time frames heroin users report relative to their subjective experience injecting.

dealers drop out of the simulation if they: 1) do not have customers, 2) run a supply "surplus" for too long (a model parameter), or 3) get arrested (see below).

4 Simulation Results

All simulations are initially setup with 500 customer agents and 100 initial dealer agents and run for 1000 days. Here, we highlight the role of customer agents' social network in: 1) the diffusion of drug dealer information through brokering and 2) heroin cost adjustments in the market. We explore four specific settings with static and dynamic social network configurations together with low and high probabilities (0.1 and 0.75 respectively) of customer agent sharing deals. In all four settings, we assume an Erdos-Renyi configuration with an initial average degree of 12 for customer agent social network. The static network composition does not change whereas the dynamic network changes as the simulation proceeds, as described in the previous section. We also assume a high-risk situation with a baseline probability of a dealer agent being arrested (random removal) set high (0.01) but multiplied by the number of customer agents a dealer agent is linked to. This assumption simply reflects the more customers who know a dealer the more likely that dealer will be informed upon and consequently arrested. Although in real life dealers spend considerable effort avoiding arrest [8], this assumption reflects a fairly accurate baseline condition.

Fig. 1 shows the time-series chart for the number of dealer agents for respective simulations runs of the four configurations. As Fig. 1 shows, dealer agents survive with static networks and dynamic networks with low brokering. The market's collapse under the dynamic network configurations can be explained by the survival of dealer agents in the system, and how dealers' information is diffused among the customer agents through brokering of deals. In our model, dealer agents drop out through police arrests, or when they are unable to sell drugs to customer agents for some time (default: 7 days). On the other hand, new dealer agents enter into the system only when an existing dealer franchises. Under our high-risk situation, dealer agents get arrested at a much faster rate than they franchise. Also, in dynamic networks, when brokers finally share a dealer the chances are high that the dealer is already removed, earning the broker a 'bad' endorsement and more dropped ties. These intrinsic factors cause the system to fail. However, when brokering is low social ties are broken at a slower rate, suggesting this reluctance to share dealer information may not only be profitable to brokers (in terms of the taxes) but may also help the market.

Under a static network configuration, the number of dealers in the system stabilizes and reaches a dynamic equilibrium. This relates to the model parameter determining the 'dealing capacity' of a dealer agent, i.e., if a dealer agent is making a certain number of deals for a number of days it franchises its deals to a new dealer agent. Notice that here we are referring to the actual deals that a dealer agent is making per day and not the number of customer connections that it may have. A dealer agent may be known to many customer agents but may not get a deal at all. As Fig. 1 shows, even under a high risk of removal of dealer agents, the market sustains when the social network of the customer agent remains intact. Here brokerage plays a role in the

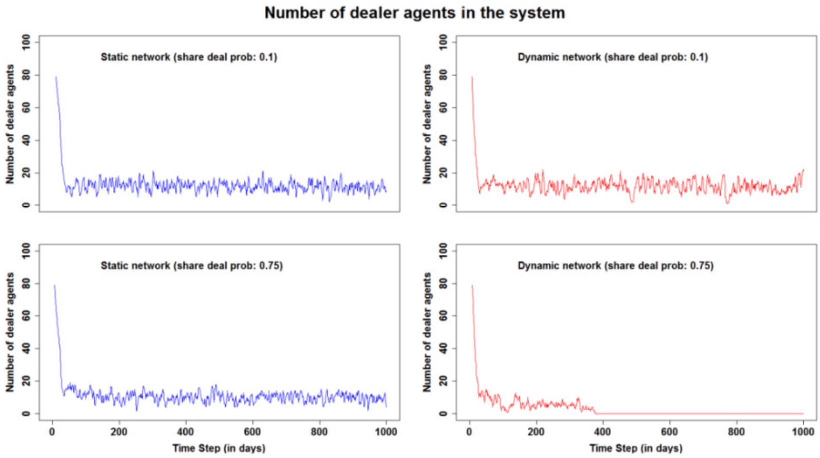

Fig. 1. Number of dealer agents for the four configurations based on the static and dynamic social network of customer agents and for low and high brokering

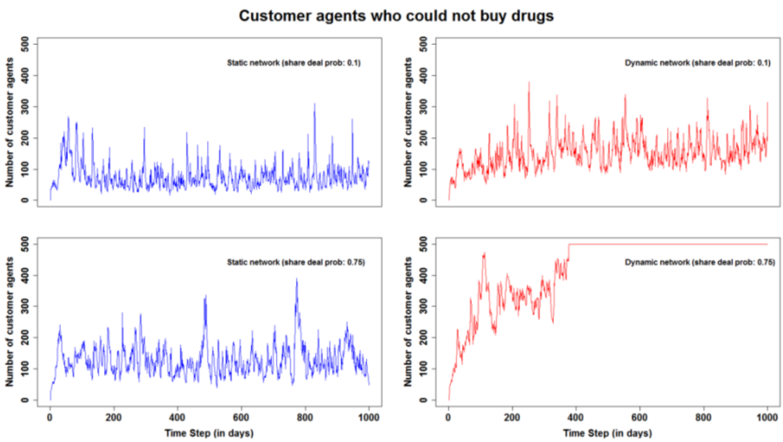

Fig. 2. Number of customers unable to purchase heroin for the four explored configurations

diffusion and redistribution of the links in the dealer-customer transaction network so that the removal rate of dealers through police arrests is balanced by the introduction of new dealers in the system. The system therefore continues to survive.

Fig. 2 shows time series of customer agents unable to buy drugs. In our model, customer agents learn about new drug dealers through their social ties. Customer agents have between 7-11 brokered deals before establishing a direct link to a dealer. Under our high-risk condition customers rely on brokering but we also find occasional spikes where a large number of customers are unable to buy drug. Counter-intuitively,

high brokerage levels result in more episodic volatility and a greater number of customers failing to buy drugs. This happens because when sharing is high there is a high reliance on shared deals, information about dealers spreads faster, and dealer agents become more vulnerable to arrest, which increases their chances of being removed before a customer connects. Low sharing results in a slower diffusion of dealer information and relatively fewer customers unable to buy drug across the 5-year period.

In terms of *cost*, Fig. 3 notes the size of grams sold by units in the four conditions. In the fixed network time series, high brokering equals high competition with unit sizes occasionally touching both 9 and 14 units per gram. But despite increased volatility, the actual price paid by the customers remains comparable across all the four configurations. Here, a high rate of brokering results in higher volatility in the time series showing the number of customer agents who were not able to buy drugs (see Fig. 2) but increases dealers' competition in the market. For fixed network settings, high brokering (0.75) results in a higher variation in unit sizes, touching both 9 and 14 units per gram. Here dealer agents are competing for customers and adjusting prices frequently. For fixed networks with low sharing of deals (0.1), we see a narrower range of prices in the time series. Notice that in our model, dealer agents do not have information about the whereabouts and sales of other dealer agents in the market. Thus, dealer agents adjust their price based on the sales in the past and although they are unaware of other dealer agents' sales, they are compelled to adjust their price based on how many deals they were able to make on the previous day. Finally, the four histograms in Fig. 4 give the distribution of annual mean Quantity-Adjusted gram price paid in the four configurations. Effects of brokering can be seen in both the static and dynamic network configurations, with all distributions skewed above the $120 retail price.

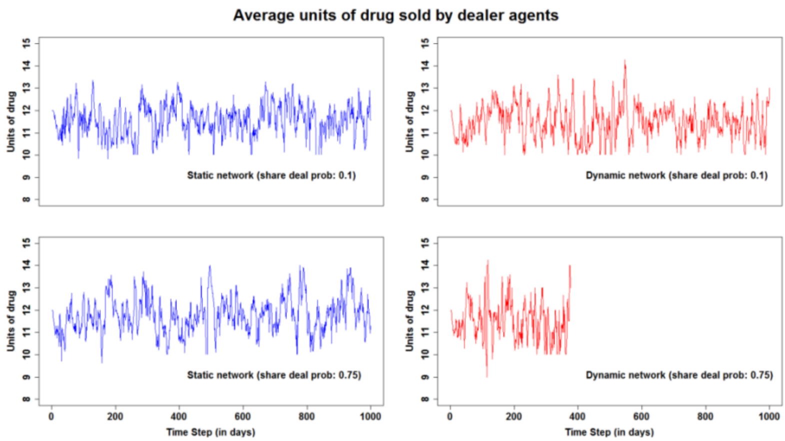

Fig. 3. Heroin unit size variation in grams being sold for the four explored configurations

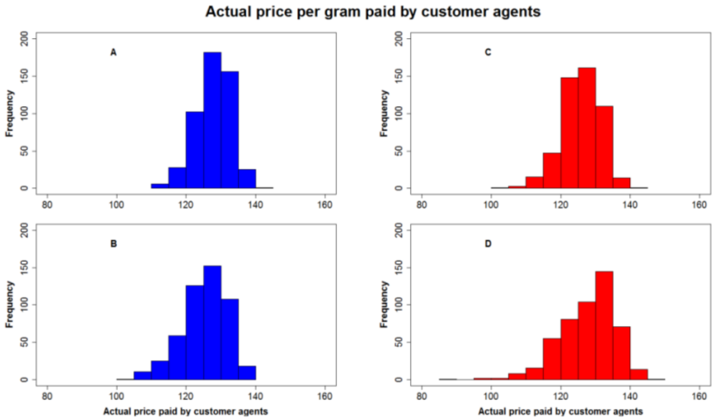

Fig. 4. Histogram of Quantity-Adjusted price per gram: static network and 0.1 share probability (A), static network and 0.75 share probability (B), dynamic network and 0.1 share probability (C) and dynamic network and 0.75 share probability (D)

5 Outlook

In real-world heroin markets, brokering is more popular than direct heroin sales and this collaborative effort (between an anthropologist who conducts ethnographic research with heroin users and dealers and a social simulation scientist) distinguishes why this is important. For consumers, brokering seems to overcome its advantage to influence better value deals in the heroin marketplace, i.e., increasing aggregate costs. However, in so doing it offers market stability under conditions of extraordinary (and unrealistic) outside pressure. In addition, brokering not only serves customer agents without dealers, it also affects competition in terms of price adjustments among dealers. Although detailed computational and social analyses remain to be presented, the findings are clear for policy: the dynamics of heroin price *do not* conform to orthodox economic models. Here logics supporting the war on drugs, i.e., arresting dealers as "supply reduction" are fundamentally defective. This paper emphasizes elevating the status of brokering as a social behavior transmitting market information and material, incorporating it into the epidemiology of drug addiction and in drug treatment / intervention efforts, in the resolve to develop effective drug policy.

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